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ABSTRACT

This research proposal supports a program in social psychology which uses a variety of game paradigms and related tasks to obtain estimates of the relative dominance of various social motives including those of maximizing own gain (individualism), joint gain (cooperation), and relative gain (competition). Numerous major studies completed or in progress provide background information on (1) the impact of various variables affecting choice behavior; (2) paradigms revealing motivational dynamics underlying choices; (3) validity of two types of models in describing the dominance of motives for choice; (4) development of motives between children in cross-cultural studies; (5) strategies of players in two-person bargaining situations and (6) the utility of statistical and other methods for analyzing social interaction. The proposed program would continue the final analysis of cross-cultural developmental studies; further develop an initial model of motivational bases of cooperative and competitive choice behavior; continue investigation of changes in strategy at various age levels and across various bargaining situations; and initiate a new program of studies on the effects of various social motives upon several learning and performance tasks among children at the second, fourth, and sixth grade levels. (WY)

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The Definition, Measurement and Development of Social Motives Underlying Cooperative and Competitive Behavior

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HISTORY

The proposed theoretical and empirical efforts represent a continuation of a research program initiated in 1964 at the laboratory for experimental social psychology at the University of California, Santa Barbara. The major effort during the first years of the program was directed toward an investigation of factors which affect cooperative and competitive choices in non-zero sum games and investigations of the development of cooperative and competitive forms of behavior in several cultural contexts. Most recently major studies have been completed in Belgium, the U.S. (two studies completed: one with children coming from advantaged backgrounds, and a second with Chicano (Mexican-American) children from disadvantaged backgrounds), and Greece. A final one is currently being conducted in Japan. Each of these studies involves a replication of the others, and all are directed towards assessing changes in motivation as a function of age in situations of social interdependence where cooperative and competitive forms of behavior are available. A preliminary theoretical and methodological rationale for this latest series of studies was included in an original proposal to NIH which was funded for two years commencing March 1, 1968. A copy of this original proposal is appended.

In addition to the above series of studies, additional theoretical and empirical efforts have been initiated during the last two years of the program. Work has been undertaken to devise methodological procedures for assessing not only the dominance of a particular social motive in cooperative and competitive situations, but also to assess the relative importance of several competing motivational orientations. This work which will be described in greater detail subsequently has concerned itself primarily with the development and utilization of a "decomposed game" paradigm (for a description of the theoretical basis of this technique, see Messick and McClintock (1968). Several pilot studies have been undertaken to assess the utility of this methodology. Work in this area at the experimental social psychology laboratory at the

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University of California, Santa Barbara, has employed college students as subjects and has focused primarily on problems of scaling. An additional pilot study in Greece was undertaken to ascertain the adaptability of the decomposed game task for children. Finally, studies are currently under way at the experimental social psychology laboratory at the University of Leuven which focus not so much on the changes in the motivational bases for cooperative and competitive behavior in children as a function of socialization, but upon changes in strategy through time. These studies are employing a simple bargaining paradigm to assess such changes.

At the present time, while the cross-cultural data is being systematically collected and analysed, the principal efforts of the program researchers is directed towards the development of a theoretical statement, more sophisticated measurement procedures, and formal models for defining and assessing a limited set of social motives which affect choice behavior in situations of social interdependence, e.g., in the classroom, on the playground, in primary group or family situaitons and in other peer group seetings.

This theoretical effort is heavily influenced by the researchers' previous theoretical statements in the area of social motivation (see, for example, Messick & McClintock, 1968), by Festinger's earlier statement of social comparison theory (1954) and subsequent empirical and theoretical work in this area (see Lantane, B., 1966), by the conceptual efforts of Homans (1961) and Thibaut and Kelley (1959) as regards the determinants, process and outcomes of social interaction, and by recent theoretical statements in social ecology (Barker, 1969). At the methodological level, efforts are directed towards finding a variety of measurement procedures to augment the use of matrix and decomposed games. Such measures should help to extend the generality of the findings thus far obtained utilizing the game paradigm. Finally, from an applied standpoint the present investigators have been impressed with the availability of a variety of aptitude and achievement measures which can be employed to assess both academic potential and achievement in the classroom setting. However, they have noted the existence of few standardized methods for assessing various social motives which play an instrumental role in determining classroom performance. Hence, the program has as one major goal the development of procedures for assessing such motives. Such measures should

provide additional insight into how social motives operate under various classroom constraints to influence academic achievement, and various forms of cooperative and competitive behavior.

SOCIAL MOTIVATION AND THE GAME PARADIGM

In the preceding section we noted a number of theoretical areas which are influencing our current conceptual efforts to understand the development and the operation of various social motives in children and adults. In the present section of this proposal, we will review briefly some of the implications which we believe each approach has to the problem area under consideration. There will be no attempt made at a complete conceptual synthesis across these orientations since in essence this is a continuing process.

Historically, decision and game theory have heavily influenced our conceptual and methodological efforts. Therefore, we will outline briefly the relevant history of this area tracing its conceptual development and noting some of the major problems which have been encountered. In a number of ways the history of our own program is congruent with the area's more general history. The materials included here are, in some instances, outlined in more detail in the 1968 two-year program proposal on cross-cultural research which is appended.

The zero-sum game paradigm is an appropriate starting point in our review since the adequacy of the assumptions made to prescribe zero-sum game behavior will certainly bear directly on a conceptual analysis of non-zero-sum games as utilized by social psychologists to assess cooperative and competitive behavior. Von Neuman and Morganstern (1944) developed the theory of games to deal with the economic problem of finding, "...an exact description of the endeavor of the individual to obtain a maximum of utility." Their concern was to prescribe choice behavior in situations of social interdependence, and thus they developed a prescriptive theory of rational strategy. They observed that the basic strategic problem in a social exchange situation from a decision theory standpoint is that the person must, in order to be rational, attempt to maximize a utility function for which he does not control all the variables. Furthermore in order to state how a person should go about behaving in order to obtain an outcome with the highest utility, a number of assumptions were required. Two sets of such assumptions may be mentioned here. First, there

are axioms concerning utility to be satisfied: man is assumed to be capable of weakly ordering objects or combinations of objects (which implies transitivity of preferences), thus guaranteeing a utility which is numerically measurable and representable in the classic outcome matrix form. Second, certain psychological assumptions are necessary. Specifically, a hypothetical man is assumed who is motivated to behave rationally (as stated above), who possesses all relevant information, i.e., he knows all possible actions and corresponding utilities for both himself and the other person, and who has the necessary genius to compute all the possible outcomes and strategies for both. Given a symmetry in motivation between participants and complete information and recognition of all characteristics of the interdependence including what one's own and the other person's utilities are for various outcomes, a rational choice strategy is given by the minimax prescription. Both individuals in a game situation should select those strategies which minimizes their maximum possible losses.

Experimental studies, however, have found that these assumptions can not be met. First, studies in individual decision making indicate that preferences are not strictly transitive (see Luce and Suppes, 1965). Secondly, players in zero-sum games do not necessarily examine the game from the opponents viewpoint (Morin, 1960). Third, interpersonal comparison of utilities seems a priori unreasonable: people do not usually know an opponent's utilities for all outcomes. Fourth, if an opponent deviates from the prescribed strategy (for whatever reason), game theory provides no basis for exploiting the state of affairs to one's own advantage. This may occur, for example, when the optimal strategy is mixed, and both Lieberman (1962) and Messick (1965) show that such exploitation does take place. Lastly, in many, if not most, social situations, even a highly competitive nature, the subjective utilities of players do not sum to zero or any constant value, and in fact as we will attempt to show they are strongly influenced by considerations of social motivation.

Given in particular the last two considerations, the focus of game theory shifted to non-zero-sum games. At first, investigations of non-zero-sum games behavior attempted to define prescriptions for rational strategy for an individual whose utilities (as well as those of the other player) were known, and displayed in a non-zero-sum matrix (see Luce and Raiffa, 1957; Nash, 1951; Von Neuman and Morganstern, 1944). In this prescriptive approach, the motivation to

maximize utility was assumed and it was assumed that the matrix outcomes represented these utilities (Luce and Raiffa, 1957; Thibaut and Kelley, 1959). This prescriptive approach to non-zero-sum games is founded in part on the same problems as those encountered in zero-sum games, plus the additional motivational complexity inherent in these situations. However, the motivational complexity and "dilemmas" of non-zero sum games also increased their usefulness as analogues for "real life" situations of social interdependence.

In the descriptive game research undertaken in the last decade, the primary emphasis has been upon employing non-zero sum games as analogues to cooperative and competitive situations in "real life." In recent social psychological theory, cooperative behavior is assumed to obtain when "promotively interdependent goals" are dominant (Deutsch, 1949) or when behavior leads to mutual reinforcement (Zajonc, 1966). Similarly, competitive behavior obtains when "contriently interdependent goals" are dominant, or alternatively, when behavior leads to negative mutual reinforcement or to the prevention of positive mutual reinforcement. It should be noted that the game paradigm, given this definition of cooperation and competition, does have a number of major advantages as an analogue for investigating cooperative and competitive behavior.

First, the game paradigm provides a well controlled interaction situation in which there exists a clearly defined set of alternatives which fit the gross characteristics of the definitions of interdependence of a promotive or contrient sort. Second, there is an easily quantifiable and unambiguous dependent variable allowing for ease of quantitative analysis and model development. Third, the experimental method is less subject to the vagaries of procedure and experimenter than other methods used to study cooperation and competition and is easily adaptable to various subject populations including children. Fourth, the paradigm potentially provides a convenient framework for studying how motivation, strategy, decision making, person perception, etc. define cooperative and competitive choice behavior. And, fifth, the paradigm provides a means for studying cooperation and competition relatively unconfounded by factors such as ability level and skill. Other points could be mentioned, but it is clear that the advantages of the experimental game paradigm are numerous. As a result, there have been literally hundreds of studies conducted with the basic purpose of studying cooperative and competitive behavior and its determinants within

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the framework of social interdependence. Nearly every psychologist is familiar with at least a few of such studies, and no attempt will be made to review them here (see Appendix for a partial review). Perhaps this plethora of studies using the game paradigm may be diagnosed as an understandable case of "paradigm fever," not a unique malady in the annals of psychology.

A number of difficulties with the non-zero-sum game paradigm become obvious, however, when one begins to ask questions about cooperation and competition at a more detailed level. Such questions arise when one considers cooperation and competition from the viewpoint of decision theory, various theories of social interaction, the actual interdependence structure of the game, as well as the Ss' actual choice behavior. A first and very important question has to do with what utilities are actually associated with the numerical stimuli to which the players are responding. Historically, there seems to be a weak, tacit assumption that no one really accepts that the numbers are utilities. One reason for this is that Ss do not behave so as to optimize their outcomes. In short, it appears that there has been a tacit acceptance of the prescription of "rational" behavior, based on the assumption that the numbers entered in a matrix represent utilities (or are linearly related to utility) coupled simultaneously with a recognition that the numbers presented to Ss are in fact only stimuli which define the nature of the absolute outcomes available to Ss.

A question closely related to the discussion above deals with what the goals of the players are. What in fact are they trying to optimize? It seems fairly clear that we can say nothing about individual utilities in situations of social interdependence until we know something about the goals of a player, and that player's expectations concerning the goals of the other participant. In his now classic work on cooperation and competition, Deutsch (1957, 1958, 1960, 1962) demonstrated that a variety of goals exist which are indeed modifiable by instructing players to behave in a cooperative, a competitive, or an individualistic way. In effect, he demonstrated that by changing the Ss orientation, he could shift the values attached to the numbers of a given matrix.

Studies completed in the UCSB laboratory, in Belgium, and elsewhere, have expanded upon Deutsch's notions that motives can be manipulated (McClintock and Messick, 1965; Gallo, Irwin, and Avery, 1966; McClintock and McNeel, 1966; Marwell and Schmidt, 1968) and affect choice behavior. Data of both a

phenomenological and an empirical nature indicate quite clearly that in addition to seeking to maximize their own resources, some players in some situations treat gain relative to that of their opponent as a dominant payoff dimension while others are concerned with maximizing joint outcomes. Such findings have been found for both adults and children.

It seems quite clear that Ss do have a variety of potential goals in game playing situations which imply different behaviors for utility maximization. Further, it is clear that the same goals need not always generate the same kind of behavior. It is these and similar empirical observations which have led to a recognition conceptually of the importance specifying various social motives in situations of social interdependence, and finding methods for assessing such motives and their relative dominance as a function of both individual and situational variables.

Of the three motivational orientations discussed above, it seems that joint gain is directly connected with cooperative behavior while relative gain maximization leads to competition by definition. Individualism (or own gain maximization), on the other hand, may lead to either mutual reinforcement or non-reinforcement depending on the reward structure of the game matrix used. In the classic Prisoner's Dilemma Game (PDG), individualism blocks mutual reinforcement whereas, in the Maximizing Differences Game (MDG), utilized in our current cross-cultural research with children, individualism leads to mutual reinforcement. It is clear then, that careful analyses of Ss goals, the strategies available, and the reward structure embodied in a particular game are necessary for a detailed understanding of the motivational determinants of cooperation and competition, and the behavior of Ss.

There are some basic methodological problems, however, when one is concerned with measuring motivational orientations using a 2 x 2 game situation, such as the PDG or MDG. First, if there are more than two goals operating, one cannot measure them in any simple and direct way in a 2 x 2 matrix. Nevertheless, such measurement is necessary for any detailed determination of the Ss' utility structures. The second problem has to do with a lack of flexibility within 2 x 2 game situations when it comes to assessing the dominance of particular motives within individuals. Specifically, when the same game is presented for many trials, the primary data are the proportion of cooperative or competitive

responses. However, this gives scanty information, indeed, about the relative strengths of the several motivational dispositions, or more generally, about how the utilities derived from several goals may be weighted in the situation to affect the player's choice behavior.

As soon as the notion of maximizing or "satisficing" multiple goals is introduced into one's conceptual analysis, other questions and difficulties arise with the 2 x 2 game paradigm. A most important problem is whether one can differentiate motives (goals) from strategy (instrumental acts) and, if so, how. The clearest separation of goals from strategy occurs in games characterized by a clear motivational dominance structure, i.e., in games in which, given a particular goal, a particular choice is dictated regardless of the choice of the other player. However, even here strategy considerations enter when multiple trials are presented to Ss, and when Ss can see the total structure of the situation (as they can in matrix games). For this reason, Messick and McClintock (1968) constructed decomposed games (see Appendix) in which Ss attention is focused on the outcomes which are a direct result of his own behavior, and considerations of interdependence are relegated to the background. While this seems a reasonable approach, the adequacy of the method as a measure of motivational disposition has yet to be completely tested. However, it does not seem possible to measure motivation and strategy simultaneously. The decomposed game approach seeks to minimize strategic considerations in order to obtain a more valid and reliable measure of several motivational dispositions.

Other experimenters have been only minimally concerned with Ss' motivations, and have centered on strategic factors (e.g., Pilisuk, Potter, Rapoport and Winter, 1965, and the present project's work at the University of Leuven). A number of these experimenters have used situations "richer" than the 2 x 2 paradigm simply because this simple case restricts the strategy possibilities. However, since different strategies may lead to the same choice or different choices may reflect the same strategy, we feel that an analysis of strategies cannot alone successfully lead to an understanding of basic decision processes. It would seem necessary to determine the goals operative in a situation as well as the strategies Ss employ to optimize a given outcome. Finally, even if it is possible to delineate the goals of the participants in a situation of social interdependence, there remains some question as to how adequately to measure

strategy, given that Ss' goals and strategies tend to interact in a fair game. Hence, many of the studies which purportedly have addressed problems of a strategic nature, including our own, have dealt with some complex and unspecified interaction between goals and strategies both within and between Ss. One method for approaching this interaction problem is to use a computer to play a specified strategy directed at optimizing a particular goal or goals. If one could assume that Ss goals will not change through interaction with the strategy of the other (computer), then a first step might be taken towards studying strategic factors independent of motivational complications (see Messick, 1967).

A final problem area within gaming research has to do with the development of formal decision models which can be used to characterize the choice sequences of players in situations of social interdependence. (It should be noted that we will not consider the prescriptive models which developed out of game theory considerations. As noted earlier, they have proven to be poor predictive models, beginning, as they do, with what seem to us unreasonable psychological assumptions concerning rationality and how Ss behave in gaming situations.) Some descriptive models have been developed in recent years, but none have extensive empirical work supporting them. Probably the first work using descriptive decision models was developed by Rapoport and Chammah (1965) in connection with their extensive work on the Prisoner's Dilemma Game. They briefly review several models for primarily instructional purposes. The only model to receive any extensive testing at all was a four-state Markov model. The parameters of this model are the conditional probabilities of a cooperative response following each of the four possible prior dyadic states. They show that the model does not adequately describe the time course of the four states. This failure is at least partially due to the operation of a "lock-in" effect which eliminates the constant probability across time that a particular dyadic choice will end on a given trial. This basic model has been examined more carefully by Ammon Rapoport (1966). He finds that the Markov model fails on several counts when two individuals play each other in an iterated PDG, but that it does hold reasonably well when a S is playing a "stooge" who is explicitly following a Markov chain model. Further, in an attempt to account for the changes in the parameters of the Markov Model, he successfully applies the Bush-Mostellar linear learning model to the most changeable parameter of the Markov model, thus allowing the stooge to learn to be more "trustworthy". The data indicates that such learning did, indeed, take place.

Messick and McClintock (1968) have developed and tested two models to deal with choice behavior from decomposed games (for a description of decomposed games, see Appendix). The first is an algebraic choice model originally suggested by Messick and Thorngate (1967) which proposes that the value of an alternative is the sum of two unknown functions which describe the motivational contributions of own gain and relative gain considerations, respectively. The data allow a few tests of transitivity, consistency and monotonicity (of the own gain function) which indicate that the model does not adequately describe most Ss' choice behavior. The second model postulates a stochastic choice mechanism. It asserts that on each trial there is some probability (constant across trials and individuals) that the S will be in one of four motivational states (Individualism, Relative Gain, Joint Gain, or Indifference). Whenever an individual is in any particular state, it is assumed that he will rationally pursue it. Data fits the model reasonably well, but a post hoc analysis indicates that individual differences are quite important. Studies conducted by both Williams (1967) and McNeel (1967) verify this finding.

These recent efforts to develop formal descriptive models of decision making in non-zero-sum games reflect the fact that conceptual and empirical work utilizing the game paradigm is in transition. The predominently descriptive effort to relate a multitude of cognitive, affective, interpersonal and situational variables to cooperative and competitive behavior in games is coming to a close. Emphasis is now being placed upon identifying and measuring the goals and strategies which underlie cooperative and competitive behavior. In this effort, attempts are being made to make use of theoretical efforts in related areas, to develop more adequate formal descriptive models.

In research conducted to date in the present project, an attempt has been made to identify, define and to trace the development of the various motives which are related to game behavior. Future efforts, which will be outlined in more detail subsequently, will include an attempt to develop a conceptual model for describing and understanding the development of these motives. In constructing this model relevant assumptions from social comparison and social exchange theory will be brought to bear. Furthermore, current theories of the development of social motives will be considered. Unfortunately, little work has been undertaken in this latter area although the importance of such a model to understanding

individual and group behavior has often been noted. For example, in a recent review of problems of school integration, Katz observes that little conceptualization or research has been undertaken which is relevant to understanding the motivational problems encountered by Blacks when they are integrated into a previously White classroom. However, many of the processes which he and his associates have examined (Katz, et al., 1962, 1964) point to the importance of social goals in interaction with such variables as probability of success, failure threat, social facilitation, Black-White social comparison, etc. in determining the academic performance of Black children.

Again it is apparent from the Katz review that an understanding of the development of those social motives which operate in situations of social interdependence has yet to be achieved, though it would have major pragmatic as well as theoretical importance to the description and prediction of social interaction and its impact upon the behavior of individuals. Furthermore, we are at a point where we can also begin to manipulate various social motives in a given social setting, and to measure the effects of such manipulations upon learning and performance of the individual and the group of which he is a member. Such efforts not only have potential theoretical and methodological implications for decision theory, but also for theories of social comparison, social facilitation, and social exchange.

III

MOTIVATIONAL BASES OF COOPERATION AND COMPETITION

One of the first theoretical requirements to the previous goals is the achievement of greater clarity as regards the definition of the social motives to be investigated. While such definitions tend to be implicitly imbedded in the operations used to measure them, a brief preliminary discussion of the various definitional alternatives, and their interrelationships is useful in laying out the elements of the conceptual approach currently being developed.

One can begin by distinguishing four broad classes of definitions of cooperation and competition. These definitions are in no sense mutually exclusive, rather the differences among them are differences of focus and emphasis. They tend to differ by accentuating different aspects of the interpersonal encounter. Specifically, they focus on (1) environmental characteristics,

(2) relations among individual goal structures, (3) consequences of an individual's behavior, and (4) internal (intrapersonal) motivational orientations.

1. Environmental Definitions: Perhaps the best examples of strictly environmental definitions of competition are to be found in population biology and economics. The basic feature of such conceptions is that the resources available to a species, group, industry, or whatever the collective unit may be, are insufficient to support the needs of all the actors involved. Thus, for example, in an ecological system, if two or more species require the same resource for propagation and survival, and if that resource is insufficiently plentiful to maintain each of the species involved, then those species are said to be competing for that resource. That the resource be insufficient to maintain all the units involved is an important aspect of this definition. One does not speak of competition for air among land-dwelling animals, nor competition for water among fishes.
2. Goal interdependence participants: A second, but related view of cooperation and competition highlights the interdependence of the goals of the individuals. Deutsch's (1949) definition in terms of "promotively interdependent goals" (competition) is of this genre, as is Thibaut and Kelley's (1959) distinction between goal correspondence versus "noncorrespondence of goals."

It is clear that definitions in terms of goal interdependence are closely related to environmental definitions. To the extent that individuals' "goals" are the consumption or accumulation of a resource in short supply, the result is competition by either standard. Goal centered definitions, however, provide a sizable measure of additional latitude in that they allow for competition and cooperation with respect to variables that could not be adequately described as "resources in insufficient supply." Moreover, while environmental definitions of competition have been useful, such definitions of cooperation are somewhat less appealing. Goal interdependence on the other hand provides a unitary framework with which both of these concepts may be meaningfully analyzed.

The similarity between these two definitional approaches may be exemplified with examples from the theory of games. In the sense in which we are using the notion of competition, a strictly competitive situation would be represented by a zero-sum game (or a constant sum game). In a zero-sum

situation, what one gains must be at the expense of the other(s). Hence, no matter what the quantity involved is, so long as it is desired by all the participants, there is not enough to go around. The situation is thus competitive by an environmental definition.

The second type of definition focuses on the incompatibility of the collection of individual desires. This incompatibility is incorporated in the payoff matrix for the zero-sum game through the use of utilities as the payoff entries. These utilities are scaled psychological quantities which are assumed to measure the value of the objective outcomes to the participants. Thus, in terms of goal interdependence, in a zero-sum game, to the extent that any of the actors successfully attains his goal, the other participants are necessarily prevented from attaining theirs.

3. Consequences of behavior: A third way of conceptualizing cooperation and competition stems from the analysis of the consequences or reinforcing properties of the behavior of the participants. Such a definition has been adopted by Zajonc (1966). From this point of view, cooperation leads to mutual positive reinforcement among a group of individuals while competition is characterized by positive reinforcement to one individual and negative reinforcement to the other.

While this definition of cooperation and competition refers neither to the availability of environmental resources nor to the goals of individuals, it is nonetheless entirely coordinate with the previous two definitions. The availability of environmental resources need only be restated as the joint availability of reinforcers to coordinate this definition with the first type discussed. To establish the bridge with the goal interdependence definitions one needs only to assume that the attainment of a positive reinforcer is a meaningful goal as is the avoidance of negative reinforcers. Thus when one speaks of patterns of goal interdependence one may simulataneously be speaking of patterns of mutual reinforcement.

4. Intrapersonal motives: The view of cooperation and competition adopted here is quite different from the three highly interrelated approaches discussed so far. Cooperation and competition are defined as deriving from intrapersonal motives -unrelated conceptually though not uninfluenced by environmental resources, forms of goal interdependence, or patterns of mutual

reinforcement. Competition is defined as deriving from the motive to maximize (or optimize) one's outcome relative to the outcome level of another individual or groups of individuals. Cooperation, on the other hand, is defined as reflecting the motive to maximize the joint gain of a group of individuals.

Competition

In order to emphasize the distinctions between competition as defined in terms of environmental structures, goal interdependence, or behavioral consequences, it will be useful to examine an experiment reported by Messick and Thorngate (1967). In this study, 44 female dyads played the following two-person game for 100 trials.

		Player 2	
		B_1	B_2
Player 1	A_1	5,5	2,1
	A_2	1,2	8,8

It is important to notice that this game is not "competitive" in any of the following senses of the word: (1) It is not characterized by a joint insufficiency of resources, i.e., it is possible for both individuals to simultaneously achieve their best outcome; (2) consequently, to the extent that subjects attempt to achieve maximal return, their goals are promotively interdependent; and (3) their behaviors, therefore, should be mutually reinforcing. This game lacks those features which would lead one to characterize it as competitive in terms of any of the first three conceptions of competition.

Half of the dyads in Messick and Thorngate's experiment played this game receiving feedback at the end of each trial which informed the members of the dyad only of their OWN payoff. In this condition (OWN Display), competition motives (relative gain maximization) could not be aroused since the subjects did not see the payoff matrix and since they were never informed of the payoffs to the other member of the dyad. The other half of the dyads were informed of their OWN score and the other member's score at the end of each trial (Both Display). This condition permits interpersonal outcome comparison and consequently provides the necessary (although not sufficient) conditions for relative gain maximization.

It is clear that if subjects tend to maximize relative gain when possible, there should be a higher proportion of A_1 and B_1 choices under the Both Display

conditions than in the OWN GAIN condition. This expectation is strongly confirmed by the data, with the OWN Display subjects choosing A_1 or B_1 on about 35% of the last 20 trials and with the Both Display subjects making this choice on nearly 90% of the trials. Additional experiments are reported by Messick and Thorngate (1967) which confirm this interpretation of the results.

The results of this study clearly indicate that competition, as a manifestation of an intrapersonal motive, does not necessarily depend upon the external or interpersonal characteristics assumed by the first three definitions discussed earlier. As relative gain maximization, however, competition implies the previous three definitions and, from this point of view, seems to be a more fundamental concept.

Competition, as we are now using the concept, necessarily involves interpersonal comparisons of outcomes and achievements. In order to attempt to surpass another individual's performance, one must have some idea of how well the other individual did (unless, of course, the task is such that an individual's performance is independent of other individual's efforts, in which case interpersonal outcome comparison may have an effect on performance satisfaction but less of an impact on performance <u>per se</u>). The recognition of the centrality of such outcome comparisons leads one to an appreciation of the fact that competition may be viewed as a direct result of the types of social comparison processes discussed by Festinger (1954). Festinger's focus, however, tends to be on the determinants and consequences of <u>opinion</u> comparison and evaluation whereas outcome comparison processes have a more direct bearing on <u>ability</u> evaluation.

It is doubtful, however, that competitive motives stem exclusively from evaluative needs. In unpublished experiments recently conducted in our laboratory, college student subjects playing decomposed games were provided with two independent sources of evaluative information. One source informed <u>S</u> of the average outcome attained by similar individuals playing the game. This was presumably a statistical composite of the results of the choices of many other students who had participated in the experiment. As a statistical composite it was presumably a more "objective" comparison standard than the second source which simply informed <u>Ss</u> of the score of the other individual with whom they were interacting. The experiment was contrived in such a way that an individual could perform well (stay ahead of the standard) with respect to either one of the evaluative criteria.

If S competed, he would do well with respect to the other individual's score, but he would fall behind the "average dyad." Likewise, if he chose to maximize the joint gain of the dyad to stay above the "composite" score, he would lose the competitive advantage over the other individual. The point of interest is that nearly half the Ss behaved competitively in this experiment.

This fact is interesting in that one would expect competition in the service of ability evaluation only in the absence of a more objective standard. In this experiment, a more objective criterion was available and Ss did more poorly with reference to this criterion as a result of their competition. This fact suggests the possibility that tendencies to maximize relative gain may be viewed as a manifestation of a more general psychological phenomenon regarding the relativity of the rewardingness or reinforcement value of outcomes. Myers and Atkinson (1964), for example, in dealing with the effects of differential reward on human learning, found it useful to associate the theoretical conditioning parameters on their learning model not with reward magnitude per se, but with the difference between the obtained reward and the maximum obtainable reward on a given trial. This difference is known as the "regret" associated with an outcome. Regret and relative gain are both defined as the discrepancy between an obtained outcome and a standard. Only the standars differ. Bevan (1963) has also presented a cogent case for the relativity of the "reinforcingness" of stimuli. He postulates that the reinforcement magnitude of a stimulus, which is to be distinguished from the magnitude of the reinforcing agent, is a function of the difference between the latter quantity and an internal standard which is in part determined by the average magnitude of the reinforcing agent which the organism has experienced. Bevan reviews a number of experiments that support this conception. While the standard proposed by Bevan differs from that used to define regret or relative gain, his theory is similar in that it stresses the relative nature of the effectiveness of reinforcements.

Thibaut and Kelley (1959) present a conceptual analysis of a number of social phenomena which shares much with the notions of Bevan. The position taken by Thibaut and Kelley asserts that the "goodness" of an outcome depends on the discrepancy between the outcome and the comparison level. The comparison level, which is assumed to act as an internal standard of the type described above, is defined as a "modal or average value of all known outcomes, each outcome weighted

by its 'salience', or strength of instigation, which depends, for example, upon the recency of experiencing the outcome and the occurrence of stimuli which serve as reminders of the outcome" (p. 21). The determinant of the attractiveness of an outcome, from this point of view, depends not only on the magnitude of the outcome itself, but also on the comparison level, which, in turn, is an average of all known outcomes, including those received by other individuals.

Behavior, particularly interpersonal behavior, according to Thibaut and Kelley, is a direct function of the "goodness" of the outcomes experienced in a relationship. The measurement of the goodness of outcomes is thus seen to be a necessary step for the precise prediction and understanding of interpersonal behavior. Bevan (1963), while referring to the "reinforcingness" of stimuli rather than the "goodness" of outcomes, has explicitly emphasized the need for such measurement.

As applied to the microscopic social relationships embodied in experimental games, such measurement requires that those properties of an outcome which determine its attractiveness be analyzed and that, when possible, the outcomes be scaled on a single dimension. If such a task were accomplished, our comprehension of the processes involved in social behavior would be enhanced immeasurably.

Cooperation

In the context of the motivational theory being here developed, we define cooperation as a resultant of the intrapersonal motive to maximize joint gain. Given this definition, there is no reason to locate cooperation on the opposite end of a cooperation-competition dimension or continuum. Rather, cooperation and competition can be defined as the outcomes of two of several motives which orient individuals towards particular choice alternatives. Cooperation (joint gain maximization) differs from competition (relative gain maximization) and individualism (own gain maximization) insofar as it necessarily implies an evaluation of outcomes relative to some group rather than individual product.

May and Doob's (1937) definition of cooperation is in part consonant with this orientation:

> On a social level individuals co-operate with one another when: (a) they are striving to achieve the same or complimentary goals that can be shared; (b) they are required by the rules of the situation to achieve this goal in nearly

> equal amounts: (c) they perform better when the goal can be achieved in equal amounts; and (d) they have relatively many psychological affiliative contacts with one another. (p. 17)

The sharing of goals and outcomes is certainly consistent with our orientation. However, certain specifics of their definition should be clarified. One may be motivated to maximize joint gains even when the goal is not to be shared in nearly equal amounts according to some objective criteria. Variation in the distribution of outcomes may reflect differences in power, involvement, skill, energy invested, etc., of the potential participants. Equity or near equity should be defined in terms of the subjective expectations of the participants. Given mutual expectations of subjective equity, then one can perhaps assess the liklihood of the arousal and survival of cooperative motives across individuals.

In terms of the conceptual system of Thibaut and Kelley (1959), the subjective perception of an equitable (but not necessarily equal) distribution of outcomes, and the viability of mutually cooperative choice behavior relate to a correspondence among members..."each must believe he will attain good outcomes in the portion of the [outcome] matrix associated with the [joint] goal task state." In effect, we are asserting that a situation which evokes cooperative motives among the participants does not necessarily depend upon an equal distribution of outcomes as is implied by many of the early studies of cooperation, for example, Maller's work with school children (1929). The latter defined a cooperative situation as one which stimulates an individual to strive with other members of his group for a goal object which is to be shared equally among all of them. Objective equity of outcomes may or may not be congruent with subjective equity, and either, given high correspondence, may lead to the motive to maximize joint gains and cooperation.

In our definition of cooperation as a resultant of the motive to maximize joint gain we would observe that, (a) it involves an evaluation by the individual of the outcomes to self and to others in terms of some joint product; (b) it implies that there is a high level of correspondence between these outcomes, that participants will receive some high level of subjective reward for coordinating their activities; and (c) it implies there is an awareness on the part of the actors that their responses can provide positive payoffs for the other participants, and that this, in conjunction with own rewards, becomes rewarding in itself.

Cooperation, defined in terms of the motive to maximize joint gain, implies more than Zajonc's definition, namely, that a cooperative situation obtains when the responses of an individual constitute or lead to positive reinforcement for the other. If such held, then one could obtain cooperative behavior when neither of the participants were cognizant of the fact that they were in a situation of social interdependence. Kelley, Thibaut, Radloff and Mundy (1962) have demonstrated, for instance, following some initial work by Sidowski (1957), that subjects are able to learn to reinforce one another even when they are unaware of the fact that they are in a social situation. Hence, mutuality of reinforcement may be better viewed as a necessary, but we would assert not a sufficient, condition for the arousal of cooperative motives.

Deutsch (1947) defines cooperation as obtaining when individuals are in a promotively interdependent situation insofar as "the goal regions for each of the individuals or sub-units in the situation are defined so that a goal-region can be entered (to some degree) by any given individual or sub-unit only if all the individuals and sub-units under considerations can also enter their respective goal regions (to some degree)." Like Zajonc's definition, Deutsch treats cooperation in terms of outcomes. The difficulty with this formulation is that it also does not demand awareness on the part of the actors. Furthermore such "promotively interdependent" outcome states can be generated by motives to maximize joint, own, or relative outcomes depending upon the goals of the group and the situation which obtains. Certainly, the behavior observed by Kelley et al. (1962) was cooperative given the above definition, but subjects in fact were merely attempting to maximize their own gain, to mediate positive reinforcements for themselves rather than maximize own and other's outcomes.

In other situations, mutual positive reinforcement can obtain when individual members of the group compete to maximize their own relative position and thereby increase the level of group product. Such obtains, for example, in a situation of unlimited resources. For these reasons, we find it more useful to distinguish cooperation as deriving from a single motivational state, and to view choice behavior as a function of this state. In this way, one can perhaps begin to generate, knowing the goals of individuals, those values which Thibaut and Kelley assume in their various outcome matrices, and which they then employ to account for various patterns of social interaction.

IV

METHODOLOGY - CURRENT AND PROPOSED

One methodological focus of the present work is upon finding reliable measures of social motives and strategies. In previous research in this area we have utilized various types of matrix games, e.g., Prisoner's Dilemma Game (PDG), the Maximizing Difference Game (MDG), and the Triple Dominance Game (TDG). Furthermore certain simple types of bargaining situations have been employed to investigate strategy. We will not present these paradigms here since they are outlined on pages 2-11 of the 1968 proposal which is appended.

In addition to the above paradigm, a number of descriptive and statistical techniques have been developed to analyze interactional data. It might be noted that the further development of such techniques is a prerequisite to theoretical progress in the area. The fundamental problem, of course, is that most available analytic procedures have been designed to accomodate response measures aggregated across single individuals, and any form of experimenter-subject or subject-subject interactions are controlled. Rosenthal (1966) has, of course, demonstrated to the dismay of few social psychologists, that these controls have often been less than adequate. But in the study of social interaction, it is obvious that what once was controlled (or assumed to be) is now the fundamental behavioral data of concern.

Techniques which are currently in use include those analyses developed by Rapoport and Chammah (1965) which include the description of matched response, state conditioned propensities (the probability of a given individual response given a prior dyadic state), transition probabilities (the probability that a given dyadic response state at time t will be the same or change to another state at time $t + 1$), and variance analyses developed by Messick and McClintock (1967). The latter permit one to consider both within and between dyad variance within and between experimental conditions. In one sense, these are relatively primitive analytic techniques for describing the rich complexity of interactional data, and further efforts are being expended to develop more sophisticated methods.

Decomposed games: One major effort of our program centers around the development of decomposed games as a methodological device for obtaining estimates of

social goals in situations where strategic considerations are minimized. Decomposed games use a method of displaying payoff information which permits a simple, direct, and flexible means for the assessment of motives in a game-type situation. The procedure may be described as follows: Each player in a dyad is given a choice between two options, X^1 and Y^1 for Player 1 and X^2 and Y^2 for Player 2. Each option is an ordered pair of numbers ($\underline{c}$, $\underline{d}$), where the first number denotes the payoff to the subject making the choice and where the second, $\underline{d}$, denotes the payoff to the other person. We will be concerned only with symmetric decompositions in which $X^1=X^2$ and $Y^1=Y^2$. Under these circumstances the correspondence between the decomposed game and the traditional payoff matrices used in matrix games is easily seen: if $X^1=X^2=(\underline{c}_1, \underline{d}_1)$ and $Y^1=Y^2=(\underline{c}_2, \underline{d}_2)$, then $a_{11}=b_{11}=\underline{c}_1+\underline{d}_1$; $a_{12}=b_{21}=\underline{c}_1+\underline{d}_2$; $a_{21}=b_{12}=\underline{c}_2+\underline{d}_1$; and $a_{22}=b_{22}=\underline{c}_2+\underline{d}_2$. Clearly, one can find the payoff matrix for any symmetric decomposed game.

The converse, however, is not true. It can be shown that the necessary and sufficient condition for a symmetric, two-person, two-choice game to be symmetrically decomposable is $a_{11}-a_{12}=a_{21}-a_{22}$. Furthermore, for any symmetrically decomposable game, one can find an infinite number of symmetric decompositions since if X,Y is a decomposition, so is X^*,Y^*, where $\underline{c}_i^*=\underline{c}_i+\underline{e}, \underline{d}_i^*=\underline{d}_i-\underline{e}$, and $\underline{e}$ is any real number.

It remains now to spell out the relationship between decomposed games and dominance games such as the PDG, MDG, or TD games which were formally outlined in the original cross-cultural proposal (see Appendix). Dominance games were defined as payoff matrices having specified types of dominance relations on their rows and columns. Decomposed games can also be characterized by such dominance structures in the following manner: we say that one choice, say X, dominates the other with respect to own gain iff $\underline{c}_1 > \underline{c}_2$; X dominates Y with respect to relative gain iff $\underline{c}_1-\underline{d}_1>\underline{c}_2-\underline{d}_2$; and X dominates Y with respect to joint gain iff $\underline{c}_1+\underline{d}_1>\underline{c}_2+\underline{d}_2$. Of course the choices may be equal on any of these three value dimensions.

There are three direct consequences of this classification of decomposed games according to their dominance properties. First, excluding the null case in which the options are equal on all three dimensions, there are exactly six dominance structures which can characterize a decomposed game and these are the same six that exist for payoff matrices. Second, unlike payoff matrices, every

symmetric decomposed game is a dominance game in that it has one of six possible structures. While many payoff matrices lack motivational dominance structures of the type being considered here, all decomposed games have such a structure. Finally, a decomposed game possesses a particular dominance structure if and only if its associated payoff matrix is characterized by the same structure. This simply means that the dominance structure of the payoff matrix in a two-person, two-choice mixed motive game is invariant under decomposition and "recomposition." This last feature is obviously important since it guarantees a formal isomorphism of payoffs between decomposed games and payoff matrices.

Examples of two decomposed games are given below with their associated payoff matrices. It can be seen that in the decomposed game the subject has complete control over the payoffs which he and the other player will receive as a function of the subject's choice. Interdependence can be maintained by informing the subjects that the payoffs to themselves and the other player

Decomposed Game 1

(Own, Joint, Relative Gain Motives lead to an X choice)

	Choices	
	X	Y
Own Payoffs	3	1
Other	1	0

Corresponding Matrix Game

		Player 2	
		X	Y
Player 1	X	4,4	3,2
	Y	2,3	1,1

Decomposed Game 2

(Own and Joint Gain Dictate a Y Choice; Relative Gain an X Choice)

	Choices	
	X	Y
Own Payoffs	5	8
Other	2	6

Corresponding Matrix Game

		Player 2	
		X	Y
Player 1	X	7,7	11,10
	Y	10,11	14,14

are a function of both what they assign to themselves and the other player, and the assignment made by the other player. Thus the interdependence and hance strategic considerations can be minimized.

The motivational isomorphism between decomposed and matrix games is illustrated by these examples. In the second example, Game 2, it is clear the subject will choose Y either if he is trying to maximize his own score (8>5) or if he is trying to maximize the joint score to the dyad (8+6>5+2). He will choose X, however, if he is trying to maximize relative gain (5-2>8-6). Inspection of the corresponding matrix game reveals that the Y choice dominates the X choice with respect to own (10>7 and 14>11) and joint (10+11>7+7 and 14+14>11+10) gain, while X dominates Y with respect to relative gain (7-7>10-11 and 11-10>14-14). Thus, the motivational implications of the two choices are equivalent in the decomposed and the matrix games.

From the preceding examples, it is apparent that the experimenter has considerable flexibility in changing the motivational structure of the situation for subjects through the course of an experiment. He can manipulate not only the relationships among the three motives under consideration, but can change their relative magnitudes by systematically manipulating the absolute and relative point values afforded the subject and the other player. This capability provides a possible means of scaling the relative strengths of the various motivational predispositions which are represented in decomposed games.

Finally, it should be noted that decomposed games provide a particularly useful method for measuring interpersonal motives. Research to date in the area of games fails to differentiate clearly between motivation (goals), and strategy (instrumental acts). For example, in a typical study, a subject may adopt a cooperative strategy (permitting both own and other to be rewarded) in order to satisfy one of several different motives. In the present task the structure of the choice matrix is designed to differentiate between motivational orientations, and to afford the subject little control over the other player's behavior. Given this, the preferences of the subject would seem more likely to be a direct expression of his goals rather than a method for influencing the other player's choices as an indirect method for achieving his goals.

Work to date on decomposed games indicate that it represents an effective means for investigating those motives which underly choice behavior in social situations where one's choice has implications both for one's own and another's outcome. Several studies which we have conducted indicate that, (1) one can manipulate the strength of various interpersonal motives, as measured by the

techniques described in Messick & McClintock (1968), through manipulations of environmental parameters; (2) individuals can be clearly differentiated in terms of their hierarchies of motivational dispositions in a given situation; (3) the choice data seems potentially susceptible to some form of multidimensional scaling analysis; and (4) the technique is adaptable to developmental studies with children.

In addition several major studies are currently in progress expanding upon the points mentioned above. In terms of the proposed project, part of our efforts will be devoted to an attempt to develop a systematic method for scaling choice data obtained in decomposed games so as to obtain estimates or measures of the relative strength of the motives under consideration. In pursuing this project, there are a number of general questions which are under scrutiny: What is the nature of psychological similarity in the present instance? Is it invariant in terms of experimental procedure, stimulus context, or subjects sampled? If not, how do these variable affect our scaled results? Given various scaling procedures, which has the strongest heuristic properties? And more specifically, what criteria should one invoke to select and to develop a particular scaling procedure? In attempting to answer such fundamental scaling and measurement questions, we will be utilizing data from studies which will be initiated to test theoretical as well as other methodological propositions.

Other experimental tasks: Within the context of the present project, work is going on in the development of other tasks for investigating social motives and strategies. This work, for instance the current studies on the development of strategies in a bargaining situation utilizing children as subjects being conducted at the University of Leuven, is concerned with extending the generality of the findings from game studies as well as validating them in other social situations of social interdependence.

A review of prior studies on cooperation and competition with children reveals that there is a paucity of paradigms which have been developed to measure social motives. One of the few experiments which developed a methodology for measuring social motives in situations of social interdependence is the earlier cited study by Masden (1967). The study investigated the effects of markedly different socio-economic backgrounds upon the cooperative and competitive behavior of 8 and 9-year old children. Utilizing Mexican children drawn from urban middle class,

urban poor, and rural Indian villages, he observed that there were no differences between children in these groups in their willingness to share candy (altruism) under two conditions, (1) when the donor was to be identified, and (2) when the donor was anonymous. Furthermore, the conditions themselves produced no differences in behavior. What is perhaps surprising is that on the average the other child was given approximately one piece of candy out of five--even though the children knew their behavior was being observed by the investigator. A second part of the study indicated again that there were no differences as a function of socioeconomic background when children were rewarded on the basis of how many "X's" they circled for him when they traded papers (cooperation). However, the competitive instructions produced enhance performance relative to the cooperative one.

The third and fourth parts of the study employed a game which was played by four children simultaneously. As described by the investigator:

> The apparatus consisted of a board 18 in. square with a small eyelet screwed into each corner. This enabled a child stationed on each corner to pull a string through the eyelet toward himself. Four strings were fastened to a common object in the center of the board. Because the string was strung through the eyelets, each child could pull the object in only one direction--towards himself. Thus the children had to cooperate to move the object to any position on the board that was not in a direct line from its starting position in the center to one of the corners. The object being pulled was a metal weight which served as support for a ball point pen filler. The pen protruded downward through a hole in the center of the weight and constant downward pressure was maintained by an elastic band. Thus, by covering the board with a piece of paper for each trial, a permanent written record of Ss' responses was obtained.
>
> pp. 1311-1312

In addition circles were drawn in the center of the four quadrants formed by the four strings. In the first of two studies using this apparatus subjects were instructed to move the pen by pulling their strings in such a way as to draw a line over the numbered circles one-two-three-four, in that order. Furthermore, they were instructed that each time the four circles were crossed in the appropriate order, each child would receive a piece of candy. The children then performed the task for five trials, the urban middle class showing the highest performance. Prior to the sixth trial the name of one of the children was written on each circle, and they were told that each would be rewarded individually each time the pen crossed his own circle. The results indicated in general that under the individual gain instructions, the urban middle class showed the greatest increment in competition, and hence received the lowest number of rewards.

In the final part of the study the position of the circles on the paper were changed so that each person had their own circle directly in front of them. Hence, by pulling the pen directly he would cross his circle. A piece of candy was offered for each time the pen crossed one's circle. If the line drawn by the pen deviated more than one inch from the center circle to an individual's circle, or reversed in direction, a competitive response was scored. In effect this reflected whether other's were pulling at the same time as given player. Again the middle class urban children were found to be significantly more competitive than the other groups.

We have reviewed the previous study in some detail because it shows commonality with the conceptual orientation which we have been developing, and it is illustrative of how a variety of task can be designed for detecting those social motives which we have stressed. Our future efforts in this area will include developing and conducting studies employing a variety of behavioral tasks. As an ultimate goal we hope to develop a standardized paper-and-pencil task which can be administered with as much facility as current measures of aptitude and achievement. The strategy of the present project in this regard is somewhat different from the usual procedures. Namely, we hope to develop first a series of behavioral tasks which can be used for diagnostic and research purposes, and then proceed to the development of questionnaires using the former as criteria for evaluating the latter.

V

FUTURE PROJECTS

In the preceding two major sections on theory and methodology, we have outlined our prior work relative to the major goals of our research program. In terms of future work, we envisage continuing research in four major areas, each area having relevance to both theory and methods.

The first area involves the completion of our series of cross-cultural studies on the development of the motive to maximize relative gain (competition). Data have been collected and analyzed for three cultures, the U.S., Belgium, and Greece. Data collection in Japan has been delayed by the student occupation of the Psychology Department at the University of Hokkaido. However, we anticipate that this research will begin in the near future. In addition we are completing testing a population of Chicano (Mexican-American) children, and will compare the development of social motives between this sample and another drawn from White, middle-class children. In the data analyzed to date we have observed, although there exist cultural differences, that across cultures there is a marked shift towards the motive to maximize relative gain resulting in competitive choice behavior.

The second area involves the further development and utilization of decomposed games to obtain estimates of the relative dominance of the various motives which underly cooperative and competitive behavior, and to test hypotheses deriving from our theoretical statement of social motives and social exchange. In addition, in this series of studies we will be concerned with examining methods for scaling responses so as to be able to distinguish relative dominance of motives in terms of some measurement space. Subjects for these initial studies will be drawn primarily from college students since they are more easily and readily available to the researchers. A specific proposal for the next study in this area follows in the subsequent section.

A third series of studies which has already been initiated at the social psychology laboratory at the University of Louvain and at our laboratory, is concerned with strategic responses, both in their developmental aspects in children, and in bargaining studies with adults. Results with children to date

are consonant with our prior work insofar as one observes increases in competitive behavior with age. A report of present and planned studies in bargaining between adults is included in the next section.

And finally, a fourth series of studies is being initiated to examine the effects of various social motives upon human behavior in situations of social interdependence. The paradigm which we have developed and is in the process of being instrumented is described in the subsequent section.

VI

PROPOSED NEW OR CONTINUED STUDIES--SOME SPECIFIC INSTANCES

A. Cross-Cultural Studies of the Development of Social Motives

At the end of the current academic year, data will be collected and analysed for a three-way comparison of cultures: U.S., Belgium and Greece. These data include responses made by 2nd, 4th and 6th grade children across a 100 trials of a MDG, phenomenological reports in trials 101-110, and response latencies for the first 100 trials. A major analysis has been completed on two cultures and is already reported in the literature (McClintock & Nuttin, 1969). The Japanese data will be analysed when it becomes available. In addition, data will have been collected and analysed on American middle class White and Chicano (Mexican-American children) of the same ages. Part of the proposed grant would be used to complete the final write-ups of the uncompleted portions of this large descriptive study. However, except for the Japanese replication, no new data collection or analyses will be undertaken. In effect, this will represent the final completion phase of a three-year cross cultural study partially funded by NIH which has involved testing approximately 450 2nd, 4th and 6th grade dyads in five cultural contexts.

B. Decomposed Games: Measuring and Scaling Social Motives

The model to be described here is an extension of the stochastic choice model developed for two-choice games by Messick and McClintock (1968). The model is revised to make predictions about choice proportions for three-choice games on the basis of four motives for choice.

It is assumed here that for each play of a game the player is in one of five motivational states. He may maximize his own gain (s_1), maximize his gain

relative to his opponent (s_2), maximize their joint gain (s_3), minimize his opponent's gain (s_4), or be indifferent among the alternatives presented (s_5). If he is in the indifference state (s_5), he makes his choices randomly, choosing each alternative with probability 1/3. The probabilities of a player being in these five states are v, w, x, y, and z, respectively. It is assumed that these probabilities are independent of the previous trial.

When the player is presented a game which does not allow him to make a well-defined choice given his current motivational state, he is assumed to move to a new state with probabilities v, w, x, y, and z, respectively. Thus, it is possible for him to return to his original state. If so, he moves to a new state again until he is in a state for which the game is well-defined or in the indifferent state, s_5.

It is possible to write the expected choice proportions for the eleven classes of games as a function of the postulated parameters, but first a notation must be developed.

Each game class is characterized by the choices which lead to the appropriate motives. The identification of a game consists of an ordered 4-tuple, ordered from left to right in terms of own gain, relative gain, joint gain, and minimizing opponent's gain. Thus, a "1" or a "2" is entered in the first position to indicate that an own gain choice is scored as a "1" or "2", respectively, unless all three options are equal in own gain, in which case an "X" appears in the first position. In the second position, the same number, a "1" or "2", is entered if relative gain leads to the same choice as own gain. If relative gain leads to a choice other than own gain, a different number, a "1" or a "0", is entered. If relative gain is constant over the three choices an "X" is entered. The same procedure holds true for the third and fourth positions, representing joint gain and minimizing opponent's gain, respectively. For example, in the game class 2210, own and relative gain lead to the same choices and joint gain and minimizing opponent's gain lead to different choices. In the game 1X10, own and joint gain lead to a "1" choice, minimizing opponent's gain leads to another, and relative gain is equal across the three choices.

The choice proportions are stated by indicating the choice and the game. For example, P(1/1101) is the proportion of "1" choices from the game class 1101 and P(2/2210) is the proportion of "2" choices from the game class 2210.

The expected choice proportions as a function of the parameters may be derived for each game. In game 1111, all four motives lead to the same choice. The player will fail to choose

"1" only if he is in s_5. Thus,

$$E\,[P(1/1111)] = v+w+x+y+(z/3) \qquad (1)$$

or $$1-\,E[P(1/1111)] = 2z/3. \qquad (2)$$

Equation 1 is merely the sum of the probabilities of all the states which will lead to the same choice. In all games with well-defined choices, the expected choice proportions are merely the sums of the relevant parameters. For example, the expected choice proportions for the game 2210 follow:

$$E\,[P(2/2210)] = v+w+(z/3)$$

$$E\,[P(1/2210)] = x+(z/3)$$

$$E\,[P(0/2210)] = y+(z/3).$$

For games in which one of the four criteria is controlled, the derivation proceeds differently. To exemplify the derivation, consider the game 1X10. First we find the probability that the player is in s_1 when the choice is made. There are a denumerably infinite number of mutually exclusive and exhaustive ways in which this can occur. First with probability v he will be in s_1 originally and thus will make his choice without having to move to a new state. However, with probability w he will be in s_2 and, since the alternatives are equated in terms of relative gain, a well-defined choice will not be possible and he will move to a new state. However, with probability v the new state will be s_1. Thus, after one move, the probability that the player is in S_1 is vw. The first move may put him back in s_2 with probability w, in which case another move will be made. In general, the probability that he enters s_1 after n moves is $w^n v$. Consequently, the probability that the player will be in s_1 when the choice is made is

$$P(s_1) = v + vw + vw^2 + \ldots$$
$$= v(1 + w + w^2 + \ldots) .$$

The expression in parentheses is the sum of a geometric series which is known to be $1/(1-w)$. Thus,

$$P(s_1) = v/(1-w) .$$

Similarly,

$$P(s_2) = x/(1-w)$$
$$P(s_4) = y/(1-w)$$
$$P(s_5) = z/3(1-w) .$$

So the expected values are

$$E\,[P(1/1X10)] = (v+x)/(1-w) + z/3(1-w)$$
$$E\,[P(0/1X10)] = \quad y/(1-w) \quad + z/3(1-w) .$$

In order to evaluate this model, it is necessary to obtain estimates for the parameters. These estimates are derived from the expected values of the choice proportions. To exemplify this method, the maximum likelihood estimate for v (called $\hat{v}$) is found in the following manner:

$$\hat{v} = P(1/1010) - P(1/2010) = (v + x + z/3) - (x + z/3).$$

Alternatively, other choice proportions may be chosen:

$$v = P(2/2210) - P(1/2120) = (v + w + z/3) - (w + z/3).$$

Because of the large number of game classes, there are eight such equations which give maximum likelihood estimates for both $\hat{v}$ and $\hat{w}$, seven equations for $\hat{x}$ and $\hat{y}$, and five equations for $\hat{z}$.

The most stable estimates can be obtained by using the arithmetic means of all the methods available, without affecting the number of degrees of freedom required. It should be noted that methods such as least squares and minimum chi-square which fit parameters to the data are not required for this model.

To investigate this model of social motivation, the following experiment is proposed. Dyads of like sex will play 44 3-choice games. Each of the eleven types of games (8 classes and 3 subclasses of class I) will be played four times. In two instances of each game, the own payoffs are greater than or equal to the other's. In the other two instances, own payoffs are less than other's payoffs. Empirical data from 2-choice games have shown differences in choice proportions between these two cases, referred to as case 1 and case 2, respectively. The matrices for these games are illustrated in the following table.

The games will be presented on slides projected on a screen visible to both Ss. However Ss will not be able to see each other and will be instructed not to communicate in any way. Each S will be updated on his point total and the other player's total every five trials. These displays remain visible during the entire game. Ss will be paid ten cents for each 300 points. The average winnings will be about $1.50 with a range from $1.00 to $2.00.

In the second part of the experiment, Ss will respond to paper and pencil questionaires in an attempt to predict the relative motivational effects without actual game behavior. Three such tests are planned. The first test will consist of the presentation of 66 matrices. An example of each of the two cases for the eleven games will be presented three times. For each presentation, Ss will be asked to judge how many times out of 100 they would choose one of the three alternatives.

The 44 Slides For All 9 Classes of 3-Choice Decomposed Games

Case 1: All numbers positive; Own payoffs more or equal to Other's payoffs

Case 1': Some positive constant is added to all the entries of Case 1.

Case 2: All numbers positive; Own payoff less than Other's payoff. Obtained by adding a positive constant to the Other's score in Case 1.

Case 2': Obtained by adding a positive constant to the Other's score in Case 1'.

For the table on the next page, the letter(s) above each column of a given matrix denote the motive(s) dominanted by that column. (O, own gain; J, joint gain, D, relative gain; and M, minimize other's gain.) Also note that for Class I, there are 3 sub-classes of matrices. This is the only class containing sub-classes.

CLASS	Case 1			Case 1'			Case 2			Case 2'		
I												
Sub-Class 1			ODJ		ODJ		ODJ				ODJ	
ODJ:M	10	20	30	30	50	40	30	10	20	40	50	30
	0	0	0	20	20	20	40	40	40	60	60	60
Sub-Class 2			ODJM	ODJM				ODJM				ODJM
ODJM	20	10	40	60	40	30	0	40	20	40	20	60
	10	10	0	20	30	30	70	50	60	80	90	70
Sub-Class 3	ODM				ODM		ODM					ODM
ODM:J	40	30	20	40	60	50	40	20	30	50	40	60
	0	10	20	40	20	30	50	70	60	80	90	70
II	M		ODJ	ODJ	M		ODJ		M		ODJ	M
M vs. O,D,J	30	40	60	80	50	60	60	40	30	60	80	50
	20	30	40	6-	40	50	70	60	50	80	90	70
III	ODM	J		ODM	J			ODM	J		J	ODM
J vs. O,D,M	40	30	20	60	50	40	20	40	30	40	50	60
	0	20	10	20	40	30	60	50	70	80	90	70
IV	J	M	OD	M	OD	J	OD	J	M	J	OD	M
O,D vs. J vs. M	40	20	50	40	70	60	50	40	20	60	70	40
	30	0	10	20	30	50	60	80	50	100	80	70
V	J		DM		J	DM		DM	J	DM		J
D,M vs. J:O	40	40	40	60	60	60	40	40	40	60	60	60
	30	20	10	40	50	30	60	50	70	70	80	90
VI	OJ	M		M	OJ			M	OJ		OJ	M
O,J vs. M:D	60	20	40	40	80	60	40	20	60	60	80	40
	50	10	30	30	70	50	50	30	70	70	90	50
VII	DM		OJ		OJ	DM	OJ		DM	OJ	DM	
O,J vs. D,M	30	20	50	40	70	50	50	20	30	70	50	40
	0	10	40	30	60	20	80	50	40	100	60	70
VIII	D	OJ	M	M	D	OJ	M	D	OJ	OJ	M	D
O,J vs. D vs. M	40	50	20	40	60	70	20	40	50	70	40	60
	20	40	10	30	40	60	40	50	70	90	60	70
IX	J	DM	0	0	DM	J	DM	J	0	J	0	DM
O vs. J vs. DM	40	40	50	70	60	60	40	40	50	60	70	60
	40	0	20	40	20	60	50	90	70	110	90	70

In the second questionaire, Ss will be shown one example from each of the eleven games for both cases. They will answer three questions about each of the 22 matrices. First, they judge which alternative they prefer. Next, they record why they selected that alternative. Finally, they estimate how many times out of 100 they would make that choice.

The final test gives the Ss a blank matrix structure for which they are to generate a matrix with which they would like to play. For each row of the matrix (own and other's payoff), they can select cell entries without replacement from the numbers 0, 20, 40, 60, 80, and 100. At this point Ss are told of the nature of the experiment, given their winnings, and thanked for their participation.

Data so obtained will be principally used to test the three choice model outlined previously, and to make a preliminary determination of the potential efficacy of obtaining estimates of motivational states by use of paper and pencil tests in hypothetical situations of social interaction.

C. Studies in Bargaining and Strategy

Present work on a bargaining and strategy is being conducted in our laboratory at UCSB, and at the Laboratory for Experimental Social Psychology at the University of Leuven, Belgium. Work at the latter concentrates on the development of cooperative and competitive behavior in children. Current work at the UCSB laboratory focusses on bargaining as relates to micro-economic theory, and the theory of motivation developed by Messick and McClintock (1968). A brief resumé and prospectus for this research program follows.

In micro-economic theory a seller is considered to fall into one of three possible cases. First, there is the case in which the seller is only one of many sellers all of whom offer a similar product to many buyers (the assumption of many buyers is made throughout this description), in which instance the activities of any one seller are inconsequential to the other sellers and to the buyers. This is the case of pure competition. Second, there exists the case in which the seller is the only source of a product, in which case the fates of the buyers depend exclusively on the actions of the seller. This is the monopoly case. Third, there is the case in which the seller is one of a number of sellers, all of whom offer a similar product, and in which case the number of sellers is not so large as to make the activities of any one seller inconsequential to the other

sellers and to the buyers. This is the oligopoly case, and when the number of sellers is two, the case is termed duopoly. In contrast to cases one and two, that is, perfect competition and monopoly, widely agreed upon solutions to the conflicts between parties do not exist for the case of oligopoly. Many have been suggested (see Chamberlin, 1933; Fellner, 1949; or Shubik, 1959). Hence, it is that oligopoly is the classic situation of economic conflict.

Considering only the conflict between sellers, the restriction in the oligopoly case that each seller's actions have some effect on the other sellers leads to qualitative differences between the nature of this case and those of the first two. It is the primary feature of oligopoly that the sellers are interdependent; the combined decisions of all directly and perceptibly affect their mutual outcomes. Since the market for their products is divided among them, most actions that benefit some sellers will harm the others. Any action by a given seller has, as a consequence, effects on the other sellers, thus motivating certain reactions by the other sellers which have effects, in turn, on the given seller, and so forth.

Hence, each seller finds his actions have eventual influences on his own outcomes that are not attributable directly to his actions but to those actions mediated by another agent. Whether this mediation is explicitly or only implicitly realized by the seller, he cannot escape noticing the dependence of his outcomes on exogenous forces. The seller is naturally motivated to determine the nature of the dependence and, when in conflict with the exogenous agency, to manipulate the dependence to his own advantage. This description extends symmetrically to all oligopolists, and thus oligopoly is seen to be a social situation with such aspects of psychological interest as conflict resolution, motivational bases for decisions, coalition formation, bargaining behavior, decision-making tactics and strategy, cooperation, and competition.

Experimental studies of duopoly have been a recent development in social science. One of the earlier sets of experiments was conducted by S. Siegel and L. E. Fouraker (Fouraker & Siegel, 1963). These authors attempted to test two classical hypotheses about the behavior of duopolists. The Bertrand hypothesis asserts that each seller assumes the other is not influenced by the actions of the first, and each seller wishes to maximize his own profit. In the case of price adjustment (the quantity adjustment case is a compliment of the price case)

the Bertrand hypothesis suggests that sellers will continuously lower prices until both reach a point of zero profits, to go below which would be to lose money. The contrary hypothesis, the Pareto hypothesis, asserts each seller chooses a price which maximizes joint profits. Hence the first hypothesis suggests a rivalistic or competitive behavior and the second suggests a cooperative tendency.

Fouraker and Siegel give both theoretical and experimental results indicating stability for the first hypothesis, which increased as each seller had less information about the other. These results raise the following questions which are currently being investigated experimentally. Can manipulation of the information exchange increase the stability of the cooperative tendency, as is indicated theoretically? To what extent is the duopoly taxonomically and behaviorally analogous to the Prisoners' Dilemma Game? What are the motivational bases for moves within the duopoly game and how strong are the various motivations? What bargaining and or coalition strategies and tactics are employed?

The following experiments and studies have been, are being, or will be conducted along the above lines. A replication of the Fouraker and Siegel duopoly price game with the bidding and payoff structure extended to include negative profit choices was conducted to determine if a winning bid, relative to the other seller, but nonetheless unprofitable bid, would be made and under what conditions. A similar duopoly game study permitting verbal communication at various times during play is currently being conducted. A theoretical investigation of the taxonometric properties of separable (or decomposable) 2X2 choice games (see Messick & McClintock, 1968) when extended to n x n choice linked (not graduated) form (see Hamburger, 1969) has also been initiated. Finally, an analysis of choices in duopoly and other n x n games with a model of kinematics based on quantum mechanics which promises to yield quantitative measures of social forces underlying such choices (see Griesinger and McClintock, 1969) is currently under consideration.

D. The Impact of Social Motives on Learning and Performance

At the moment we are extending our research program beyond the framework of experimental games and bargaining. In effect, we plan to utilize the insights we have gained in social motives, and measure their impact upon learning and performance in the classroom. The rationale for this extension of our efforts is both theoretical and pragmatic. As noted previously, we are committed to an

attempt to develop ways of measuring social motives and assessing their impact upon the behavior of children, particularly in the areas of learning and performance.

Hence, unlike the work discussed so far, our initial experiments will be conducted completely outside the framework of experimental games. The approach to be taken views the three social motives as just that...motives. If in fact this trio of variables, maximization of own, joint and relative gain, is a set of motives in the most general psychological sense, they should have effects on numerous forms of behavior, and not just choice patterns in experimental games. Viewed in this way, we would expect them to possess the same general properties of other motives: supplying a basis for learning and having influence on the rate of responding. The fundamental assumption in this study is as follows: To the extent that different motives possess different degrees of importance or salience, then rewards associated with satisfaction of the motives should have differing effects on behavior.

This position gains support from numerous studies of the effects of reward size, or quality on behavior. Hutt (1954), for example, has shown that the rate of bar-pressing in the rat increases with changes in reward size and reward quality of a food mixture. To the extent that rewards associated with dominant motives are of "higher quality" than those related to weaker ones, a determination of the importance of each of the three motives can be made. The most dominant or important motives should have the maximum effect on behavior, the second most salient motives will have an intermediate effect, and so on.

The forms of behavior which have been chosen for our first series of studies are learning of both a rote and conceptual type, and performance in reaction time and surveillance tasks. To date a great body of literature has resulted from the study of the effects of motivation on learning and performance, and if beyond the scope of this lengthy proposal to review them here. However, the relation of drive to behavior is summarized by Hilgard and Marquis (1961) as follows:

> "Basically the effect of increased drive is to increase the vigor of behavior. The responses so energized, however, may not be those under observation in a particular experiment. In that event, the effect of increased drive will vary, depending on the compatability between the energized response and the response being measured." (p. 434)

The responses which do become energized as a result of an increase in motivation are the dominant responses of the organism in that situation. If the dominant response is the one under experimental observation, then its vigor will increase subsequent to an increase in motivation. If some competing, subordinate response happens to be under scrutiny then motivational increases will cause this weaker response to be attenuated. These considerations lead to the following predictions:

On tasks in which the subject's dominant response is the one under observation (as in a task requiring the subject to perform a behavior already in his repertory), rewards associated with the strongest social motive will produce the highest level of responding. On tasks in which the response under investigation is not the subject's dominant response (as when the subject is attempting to learn some new response) rewards associated with the most salient social motive will impede establishment of this response to a greater degree than rewards associated with less important motives.

So far, the motive-related rewards have been spoken of in only general terms. The specific means by which they will be activated in these studies is by manipulating feedback (controlled by the experimenter) so as to tell a given subject "how he is doing" in one of three ways: Relative feedback will tell a subject how his level of performance compares (either favorably or unfavorably) with that of another subject; Own feedback will inform a subject as to the level of his individual achievement; and Joint feedback will display the level of group achievement to the subject.

Each of these three types of feedback is viewed as being a goal offered by the experimenter to the subject. To the degree that the goals are of differing reward value, subjects will be motivated to differing degrees to maximize them. In performance tasks, subjects will perform most vigorously under conditions of high relevance or reward. The hierarchy of response vigor across these three feedback situations may be taken as indicative of the relative importance of the three social motives. In learning tasks, subjects are expected to show the slowest acquisition under the conditions of highest reward.

Subjects for the studies will be 2nd, 4th and 6th grade American and Flemish children. At each grade level, 4 separate experiments (2 learning tasks and 2 performance tasks) will be conducted. In each experiment, subjects will be randomly divided into three groups, each group engaging in the same learning or

performance task but under different forms of experimental feedback. In addition to these 3 feedback groups, a 4th control group which receives no feedback will be included for 2 reasons: (1) Within a given age level it will serve as a baseline. (2) It will help one to determine if observed cultural differences at a given level are a function of motivational differences or of differing cultural capacities in the task.

The apparatus which will be used to conduct this experiment has been developed, and is currently under construction. It was designed to be as general as possible, allowing for a number of different tasks. In addition to being general, it was hoped it would prove inherently interesting to children, and would be as relatively "culture free." With these three goals in mind the following apparatus has been developed:

Each subject has a 2 foot square response panel on which pictures of 20 different animal cages have been drawn. The pictures are arranged in 4 rows of 5. Below each picture is a red push-button and to the right of each push-button is a light. This panel is used by the subject to make his responses and by the experimenter to alert the subject to specific cages on the panel (via the red light).

In the rote-learning task, the subject is shown a color slide of a cartoon, ficticious animal and is asked to learn which cage that animal "lives" in. The difficulty of this task may be varied by changing the number of animals in the series of slides. (There are 20 different animals). If the child feels that animal "X" belongs in cage "C" he presses the button under this cage. If he is correct the red light next to the button comes on simultaneous with the button push. If he is wrong, the red light under the correct cage comes on a few seconds later.

In the concept-formation task, the subject is asked to guess which of n cages (where n can vary from 2 through 12) a given projected animal should be placed in. The animals in this series vary along 3 dimensions: (1) Number of Legs (2 or 4) (2) Color of Animal (Red, Blue or Green) (3) Direction Animal is Facing (Left or Right). A wide range of difficulty is possible here, as in the rote-learning task.

In the reaction time task, before each slide is projected, dots of various colors are placed on each of the 20 cages. (Each cage has only 1 dot.) Next

an animal is projected which has on it a dot of a given color. The child's task is to find the cage with a dot of the same color and press the button underneath that cage. Before the next animal is projected the colors associated with each cage are changed.

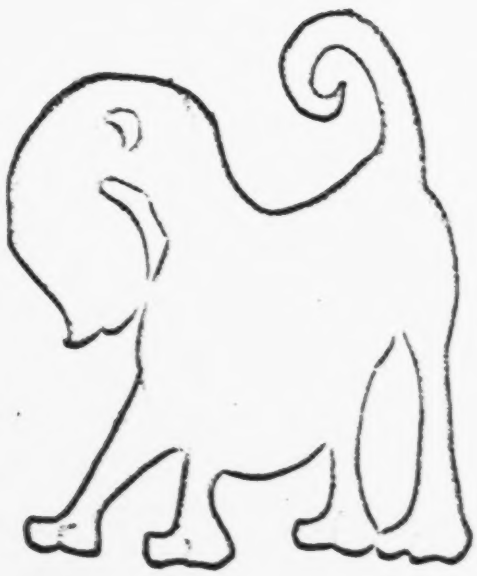
In the repetition task, each cage again is associated with a dot of a given color. Again, an animal is projected on the screen which has a certain colored dot on it. The child is instructed to begin with the top row, and move to the right, pushing the button below each cage having the same colored dot as the animal. When he is finished with this row, he goes to row 2, then row 3 and so on. When he has finished the last row, he returns to row 1 and repeats the same behavior again. The number of correct button pushes made by a child in some fixed period of time is his score.

Examples of the animals used as stimuli are included on the following pages. Color reproductions are available in the first and second copies of this proposal.

CONCEPT FORMATION

Animals vary in color, number of legs, and direction they are facing (35 mm slides are reversed to provide two directions).

RED

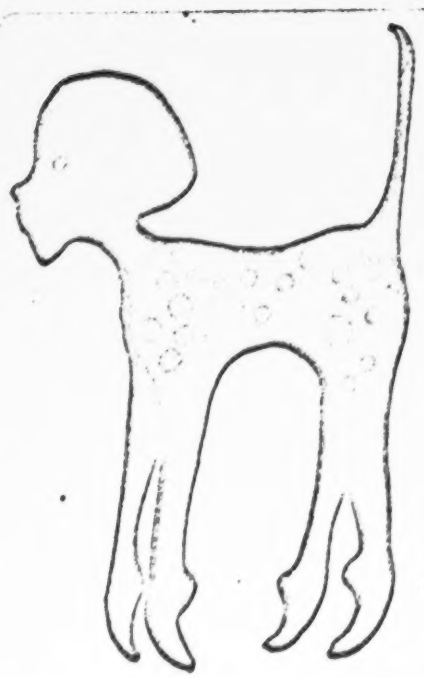


RED

BLUE

BLUE

SIX OF TWENTY FICTICIOUS ANIMALS FOR ROTE LEARNING AND PERFORMANCE TASKS



VII

SIGNIFICANCE - A SUMMARY

We would like to briefly summarize the general significance, theoretical, descriptive, methodological and applied consequences of the research program described previously:

A. Theoretical: The principal theoretical implications of the proposed research include:

1. The definition and scaling of social motives which underly cooperative and competitive forms of social interdependence.
2. The extension and modification of game theoretic principles to encompass decision making in situations of social interdependence including the development of descriptive stochastic models.
3. A preliminary examination of the relationship between induced social motives in social situations and various forms of learning and performance on language free tasks.
4. An extension of the theory of bargaining behavior proposed and instigated by Fouraker and Siegal (1963).

B. Descriptive: The principal descriptive aim of the research discussed in this proposal include:

1. A cross-cultural comparison of the development of social motives in children both as a function of age and culture.
2. A comparison of the effects of induced social motives on various types of learning and performance of children at various age levels.
3. A preliminary description of non-verbal learning and performance tasks which can be used across various age levels.

C. Methodological: The principal methodological consequences include:

1. The development of methods for assessing social motives in situations of social interdependence; in particular, the development of decomposed games.
2. An attempt to develop a paper-and-pencil task for measuring motives in a decomposed game situation in order to obtain data outside of a laboratory context.

3. The development of statistical methods for analysing data which derive from interaction settings.
4. The instrumentation of a matrix game (MDΓ) in a form understandable to children.
5. The construction of non-verbal flexible learning and performance tasks which can be used across age levels and in various cultures.

D. Applied: The principal applied potential and goals include:

1. Further understanding of the major goals and strategy affecting cooperative and competitive forms of social behavior. Since both cooperative and competitive forms of behavior are found in many social settings, and are more or less adaptive given the general task objectives of an organization, additional knowledge concerning the definition of these processes, and the variables which affect them is of considerable potential pragmatic value.
2. The definition and measurement of social motives which may affect learning, performance, and other forms of human behavior. As noted earlier, the definition and measurement of motivation has lagged far behind the assessment of achievement and aptitude. Such measures could have substantial implications for educational practices among various sub-populations of school children. One goal of the present program is to work towards a standardized measurement procedure for assessing those social motives which underly cooperative and competitive behavior.

VIII

RELEVANCE TO DEPARTMENTAL CURRICULUM

The present proposal represents a continuation of a program of research which serves as one focus of graduate education in the experimental social programs at UCSB and the University of Louvain. Funds from this program have been instrumental in supporting graduate students research experience and providing some of the laboratories equipment. For undergraduates, funds have been used to support students, to work out experimental paradigms for didactic purposes, and

purposes, and to provide some laboratory equipment. In addition, funds have been used to support students in the Work Study Program. For instance, the program currently employs eight Chicano (Mexican-American students as experimenters for a project on the development of social motives.

The theoretical and methodological efforts devoted to the project, including the use of computers and the design of logic racks and other equipment, has provided major intellectual stimulation to a number of graduate students. In addition, we have been able to generate cooperative relationships with other laboratories both within and outside this country. For instance, one of our recent Ph.D.s is currently at the Louvain laboratory for a year, and we are hosting for six months one of Japan's leading authorities in game research, Professor Umeoka, Chairman of the Department of Psychology, University of Hokkaido.

Hence, the program described is an integral part of our undergraduate, graduate and post graduate training activities.

IX

FACILITIES AND EQUIPMENT

The laboratories, both at UCSB and at Louvain, are two of the finest in the world in terms of available equipment and facilities. There is adequate space in both to conduct the proposed research. Instrumentation exists for regular matrix, decomposed game and bargaining studies. Equipment is currently being constructed for the learning and performance task described previously. The UCSB lab has on-line computer consoles and logic systems available in its laboratory. The latter lab also has two trailers attached to it which have been designed and instrumented for conducting studies in the grade school system.

X

JUSTIFICATION OF BUDGET

In concluding, we would observe that we are requesting support for a programatic approach to investigating cooperative and competitive behavior, and the social motives which underly these forms of interdependence. The budgetary requests are somewhat larger than the typical proposals since the program involves three senior personnel: Professors McClintock, Nuttin and Messick.

We have debated the strategy of submitting individual proposals, which, if taken singly, would have been consonant with the normal level of funding to single principal investigators. For a number of reasons, including our attempts at theoretical and methodological integration, and a need to reduce time, expense, and redundancy, we have decided to submit one proposal.

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